USER MANUAL

AOS Box Oxygen and Salinity

Web based oxygen and salinity logging - directly to computer

B	27.08.15	Re-approved (ECO-0000743)	EBL	MM
A	08.06.15	Approved	EBL	MM
Rev	**Date**	**Issued**	**Issued by**	**Approved by**

Document no.:	DC10000882	**Document part no.:**	100001032	**Project no.:**	86620-01

For a thorough introduction of Your AKVA product, we ask that all users read this entire manual. If questions occur, contact us!

The information in this document is subject to change without notice and should not be construed as a commitment by AKVA group ASA.

AKVA group ASA assumes no responsibility for any errors that may appear in this document.

In no event shall AKVA group ASA be liable for incidental or consequential damages arising from use of this document or of the software and hardware described in this document.

We reserve all rights in this document and in the information contained therein. Reproduction, use or disclosure to third parties without express authority is strictly forbidden.

This document can also be read and downloaded from our web site, see www.akvagroup.com/products/user-manuals

Table of contents

1 Safety 5
1.1 Safety symbols 5
1.2 Receiving a new product 6
1.3 Blind plugs, protection stockings and transportation 6
1.4 Disinfecting equipment 6
1.5 Cables 7
1.6 Bad weather 7

2 Information 8
2.1 How to use this manual 9
2.2 About AKVA group 10
2.3 About AOS Box 11

3 Installation 14
3.1 Installation instructions 15

4 Web site - access 17

5 Web site -use 19
5.1 Top functions 20
5.2 Overview 21
5.3 Details 30
5.4 Export 32
5.5 Position and Direction 34

6 Storage 35

7 Batteries 36
7.1 Turn off the AOS Box 37
7.2 Change batteries 37

8 Service and repairs 40
8.1 Shipment insurance 40

9 Maintenance 41
9.1 Cleaning the sensors 41
9.2 Maintenance registration for AOS Box 42

10 Update AOS Box 43

11 Spare parts for the AOS Box 44

12 Frequently asked questions 45

Appendix A - Index 46
Appendix B - Deviation form 47
Appendix C - Notes 48
Appendix D - Contact information 50

1 Safety

Safety for the users of our products, is top focus when developing new products and user manuals in AKVA group ASA.

Therefore, we strongly recommend that everyone that is using, performing repairs, service and maintenance on the product and also everyone working around the product, reads this entire manual, and especially this chapter on safety.

This recommendation is based on both personnel safety, as well the desire to keep the products in order and avoiding any damages risked if the safety instructions are not followed.

1.1 Safety symbols

The following safety symbols are used in this manual:

Information

Show caution, danger of damaging equipment and mild injuries to personnel

Danger! Will cause dangerous situations and danger for personnel

1.1.1 Other symbols used in this manual

Go to or see page or chapter for further instructions or more information

1.2 Receiving a new product

Always make sure that the delivery is complete according to the service note. If the order is not complete or if any other errors are discovered, contact AKVA group immediately.
Contact information is found in the back of this manual.

1.3 Blind plugs, protection stockings and transportation

Always keep the blind plugs safe after installation of your AOS Box. We recommend that all caps are kept in a safe place inside the barge. The blind plugs need to be quick and easy to locate.

When sensor cables are removed from the AOS Box, due to service shipment, changing batteries, moving or any other reason, the blind plugs must be attached to the contacts immediately.

Protection stockings must cover the sensors at all times when the sensors are not being used. Keep the stockings in a safe place, preferably in the same place as the blind plugs.

Avoid low temperatures and mechanical strain, as this will severely reduce the sensor's accuracy. Recalibration will be necessary before use after this kind of treatment.

1.4 Disinfecting equipment

If any of the equipment, cables, ropes or other belonging equipment is being moved to a new location, it is decreed by law to disinfect everything to prevent contamination. We recommend rinsing with fresh water after disinfection, because the disinfectants are strong chemicals that may damage the equipments surface materials.

1.5 Cables

Avoid twirls in the sensor cables, always coil them carefully. Make sure that all cables are in order, without tears or damages, before they are connected to the sensor or the AOS Box. Make sure that there is no tension to the cable when the sensor is placed in the water by using the chord anchorage on the mounting bracket to avoid damages to the cable plugs.

1.6 Bad weather

Always make sure that all of the equipment is ok after bad weather and storms. Bad weather may loosen the bolts and twirls in cables and suspensions that may lead to equipment damages. Therefore, it is important to check that everything is in order after stormy periods.

If anything is out of order or is damaged, contact AKVA group immediately. Contact information is found in the back of this manual.

2 Information

This user manual is part of the equipment delivered with AOS Box. Keep the manual for as long as the sensor unit is in use, and make sure that all changes to the equipment are being noted in the back of this manual.

Thank you for choosing AKVA group ASA as supplier for your sensor equipment. Do not hesitate contacting us for more information regarding installation, use or maintenance for the AOS Box or any other AKVA products.

The purpose of this manual is to make the user install, use and maintain the AOS Box in a safe and economical way. The manual will show how to install, use and maintain the product, as well as hopefully answer most day to day questions. If there is anything relevant this manual does not explain or answer, please contact us for assistance and help to find a solution to any problems. Contact the AKVA service department, your subcontractor, your local AKVA office or our main office in Norway for assistance and help.

2.1 How to use this manual

This manual describes how to install, use and maintain the AOS Box in the best and safest possible way. This entire manual must be read and understood by ALL users prior to use of the product. Site owner and farm manager are responsible for that all personnel and users know and understand the contents of this manual.
Before the first chapter, is a table of contents. The headlines works as links to their respective chapter in the .pdf-file.

Chapter 1 is the most important chapter of this manual, and includes all safety precautions ensuring personnel and equipment safety during installation, use and maintenance. Chapter 2 contains information on AKVA group and the AOS Box, as well as this manual instruction.

Chapter 3 contains a description to how the AOS Box is being installed in the cage edge, as well as preparations before this process. Chapter 4 shows how to access the website, and chapter 5 is an introduction to how to use the website and how to read the measurements shown here. Preparations before storage is explained in chapter 6 and battery change procedure is described in chapter 7. Chapter 8 includes service, repair and transportation preparations and precautions, maintenance is described in chapter 9. If the AOS Box is not prepared for use with salinity sensor, this can be done as described in chapter 10. Spare parts overview is found in chapter 11, and answers to frequently asked questions are found in chapter 12.

Four appendixes are found in the back of the manual: Index, with links to the rest of the manual in the .pdf-document, a deviation form for all deviations with the system, pages for notes about new and extra information are also in the back of the manual and AKVA contact information.

This entire manual must be read and understood before use, as well as used as aid during installation, use and maintenance of the AOS Box

2.2 About AKVA group

With four main brands, AKVA group ASA is a world leading supplier of technical aquaculture equipment. Since 1980 we have developed and produced fish farming equipment, both for cages at sea and for land based hatcheries. AKVA represents an industrial standard, which is presumed to be the turn key to the future. Research, project management, fast deliveries and customer follow-up have been our focus to ensure that we contribute to a positive development within the agriculture industry. Our goal is to deliver the best possible and most cost efficient equipment in order to keep preserving sustainable farming.

We have a wide variety of products, for example: plastic and steel cages, high pressure washers, net washers, boats, feed barges, feeding systems, cameras, sensor systems, under water lighting, software for fish farming and recycling systems.

AKVA has a continuous development of products, and we continue to improve product safety, functions, range of use and reliability. The purpose of this manual is to enable users to install, use and maintain the AOS Box in a safe and economic way.

All of our equipment is pre-installed, tested and delivered from our own production department. This means that our customers have total control over which components you can choose from, grouping collocation, testing and deliveries. Our production staff consists of people with great expertise and engagement for producing the best possible products for you. Having our own production site gives you excellent service in case something should go wrong, or if you are in need of any assistance. Our service staff is available on the telephone or on location in order to assist you if necessary. Safety, both for users and equipment is our main focus when developing products and product manuals.

2.3 About AOS Box

The AOS Box, is an independent system for measuring oxygen levels in the sea water. It is a flexible system that runs on batteries, and also communicates via Iridium satellite. All information from the AOS Box is displayed in a user friendly web site.

The AOS Box is continuously receiving oxygen and temperature measurements from the sensors. As long as the location has clear sight to the sky and continuous satellite signal, these measurements will always be available on the web site.

The delivery is, in accordance to the AOS Box unit with sensors, a plate bracket for simple installation on the cage rail plus a protection cap for extra protection during really bad weather.

AOS Box with bracket

Oxygen sensors

Salinity sensor

Both salinity and oxygen sensors have three different sensors, one red, one blue and one green. These colour codes are used to separate the various sensor depths in and outside the cage, when using more than one of each kind of sensor type with the same AOS Box.

Two sensors of the same type and the same colour may not be used at the same AOS Box, however a blue oxygen sensor may be used with a blue salinity sensor in the same box. One red, one blue and one green sensor of one type is also possible to use with the same AOS Box.

The oxygen sensors are optical sensors, and provide stable measurements for long periods because of the use of membrane measuring. The membrane will not be not be expended providing correct maintenance. Oxygen sensor measures % saturation and the website shows these values in mg/l based on a constant salinity value. Default salinity is set to 35ppt, contact Nortek if this value should be changed to accommodate the specific locations. See chapter 5.1.3 for how the measured oxygen values are presented in the graph.

The salinity sensors measure conductivity and temperature in the area where they are placed. Nortek calculates salinity from these values, and this is presented in the website. The graphs shows salinity as ppt per time. See chapter 5.1.7 for how the measured salinity values are presented in the graph.

2.3.1 Technical descriptions

Dimensions AOS Box

- weight: 4,8kg
- dimensions: 270 x 250 x 130mm

Operating voltage

3 batteries, 100Wh alkaline batteries

Environment

Operating temperature: -20°C to +45°C

Technical specifications

Sensor type	Oxygen sensor	Salinity sensor
Brand	Insite IG, Dissolved Oxygen Model 400	Ponsel CTZN: Inductive Concuctivity
Measuring area	0-25ppm	0-100mS/cm (conductivity) 0-72ppm (salinity)
Accuracy	1% of read value, or 0.02ppm	
Resolution	0.01ppm of read value < 4ppm 0.1ppm of read value > 4ppm	~0.1ppm

Data communication:

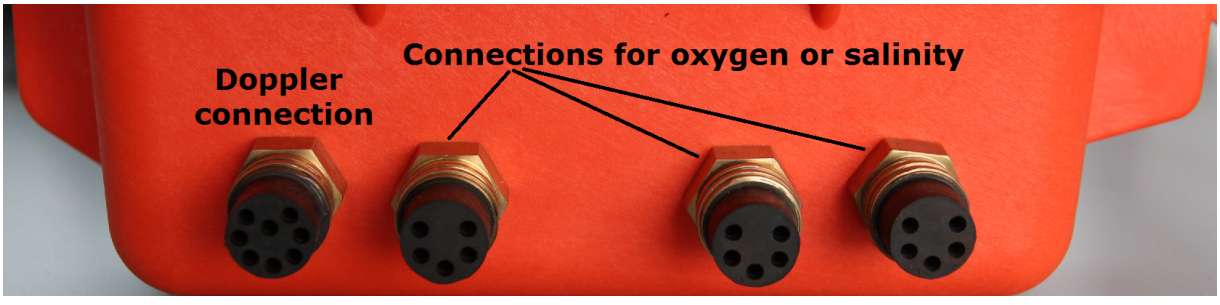
Data transference: Iridium

Data presentation:

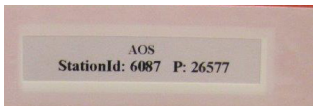
Internet: http://realfish.akvagroup.com

Contacts

Maximum 3 oxygen sensors may be connected to one AOS Box, one red, one blue and one green sensor. These will measure oxygen levels in three different depths where installed.



3 Installation



Note the StationID of the AOS Box before using it. This ID number is found on the inside of the box lid.

Before installing the AOS Box to the cage edge, it has to be activated. This is done by pressing the ON/OFF-button on the inside panel of the AOS Box for 2-3 seconds. As the system is turned on, an orange led-lamp will blink, then turn green and be lit for about one minute to indicate that the start up was successful.

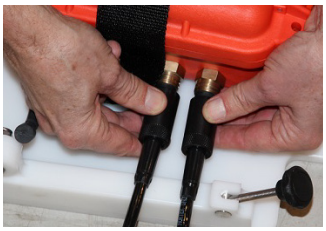
Install the AOS Box on the cage edge according to instructions in chapter 3.1. Use the plate bracket for installation. In particularly exposed locations, we recommend using extra protection to ensure that the box stays protected from wind and sea water.

No more than 3 of each sensor may be connected to each AOS Box at the same time.

AOS Box installation:

- Remove the plastic protection stockings
- Make sure that sensor membranes are intact
- Attach all sensor cables to the bracket chord anchorage
- Make sure that the sensors hang freely in the water to avoid any mechanical strain caused by strikes or friction
- Write down the AOS Box ID number, which sensors (blue, red or green) are being used and how deep the sensor is placed

3.1 Installation instructions



1 Remove the blind plugs and connect the sensors. Sensors for salinity and oxygen may be connected to the three contacts that are closest to the case handle

2 Activate the AOS Box by pressing the ON/OFF-button in the panel inside the box for 2-3 seconds. The led light will blink red for one second, then it will turn green and stay lit for about one minute. This indicates that the box has been activated properly

3 Open the bracket chord anchorage

4 Lay the case handle down and place the gray protection cap over the AOS Box (so that it covers the handle)

5 Place the AOS Box with protection cap in the plate bracket, also shown in the image below. Make sure that the black belt is placed outside the AOS Box case. Attach sensor cables in the chord anchorage, close and tighten the bolt

6 Bend any blind plugs and lay them against the chord anchorage as shown in the image below:

7 Fasten the belt around the case, and tighten it properly with the Velcro

Checklist before taking the AOS Box to the cage:

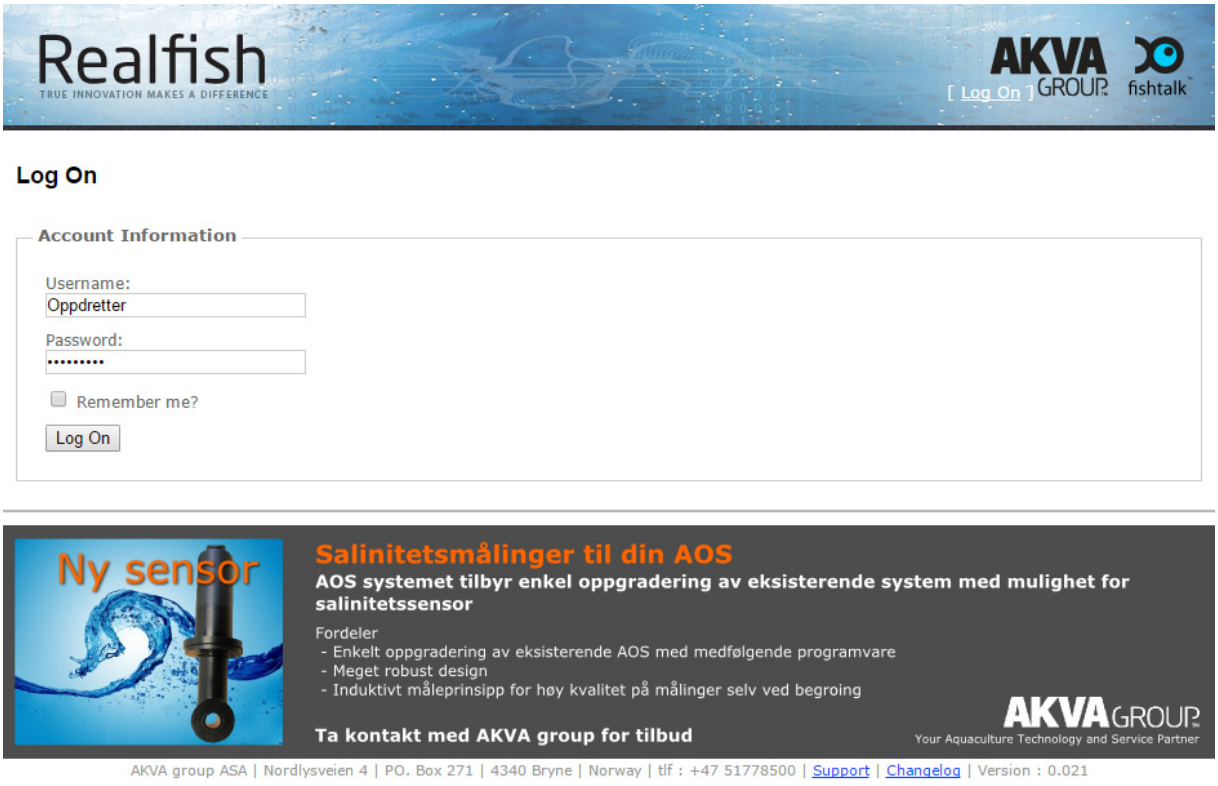
- the AOS box is activated (turned ON)
- all sensors are connected
- protection cap is placed over the box
- blind plugs connected to unused contacts
- sensor cables fastened in the chord anchorage
- belt properly fastened around the case
- bring strips or straps to attach the bracket

8 Bring enough cable ties or belts long enough to go around the cage rails and hang the plate bracket on the cage rail, on the right side of a rail pole. Use the ties or belt to fasten the bracket to the cage rail:

4 Website - access

When the AOS Box is placed in the desired location, the measurements will be available on line.

The website has this address: http://realfish.akvagroup.com



To access the Realfish oxygen- and salinity-logging website, contact Nortek and follow the instructions on the next page to receive access.

AOS web access Quick Guide

1 Collect following information:

a The AOS Box ID number
This is found on the inside of the AOS Box lid. This is the identity of the case and all remaining information is linked to this ID.

b The company name
This information will appear in the web page

c The location name
This information will appear in the web page

d GPS coordinates for the AOS Box
This information is the basis for placing of the flag in the first page in the web page

e Descriptions for the sensors (2 or 3 different)
Colour, whether it is in- or outside of the cage and depth. This information will also appear in the web page, making it easy to find data for each sensor

2 Send all the information above to: support@nortek.no

3 Receive user name and password and make sure to save the e-mail and note the information in an additional safe place

4 Go to: http://realfish.akvagroup.com

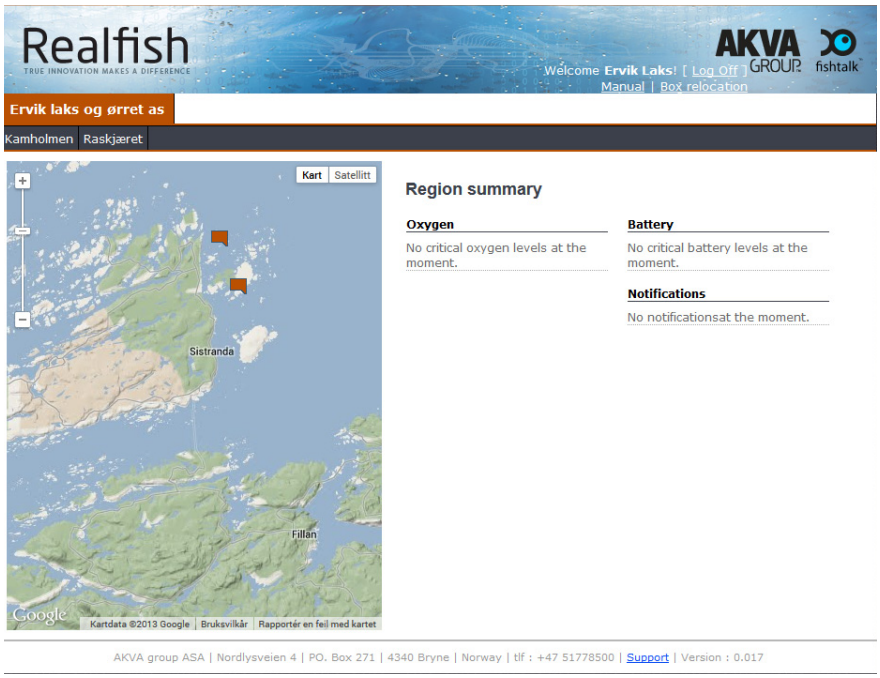
5 Type user name and password and click on 'Log on'

6 The data logging from the registered sensors may start and seen from anywhere at anytime.

! *A laminated quick guide similar to this page is found inside the AOS Box case when delivered*

5 Web site - use

The start page presents an overview to the regions for your company and shows geographic placement of your locations in selected region.



Under each region tab is a map showing all locations registered in chosen region. The colour codes state oxygen level for the different AOS Boxes where oxygen sensors are connected:

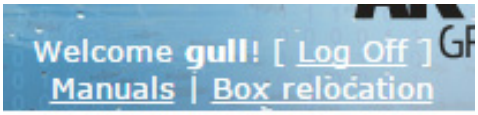
- Red colour: critical - oxygen level below 60%
- Yellow colour: alarming - oxygen level around 60-75%
- Green colour: ok - oxygen level above 75%

Notifications will show in the interface, however only when the oxygen levels are critical for one or more AOS Boxes in the region. Under the regions, locations in the region is listed in their own banners, and the user may click on these to see the information from the desired location. The locations may also be chosen by clicking on their flag.

The AOS AKVA Sensor Buoy user manual contains more information on the buoy and current measuring. This, and other AKVA user manuals are found in the AKVA website: www.akvagroup.com/products/user-manuals

5.1 Top functions

In the right side of the blue top part of the website, are four different functions:



Welcome [location name] !

- shows which location is logged on. This is useful for users who have access to several locations in one log-in

Log Off

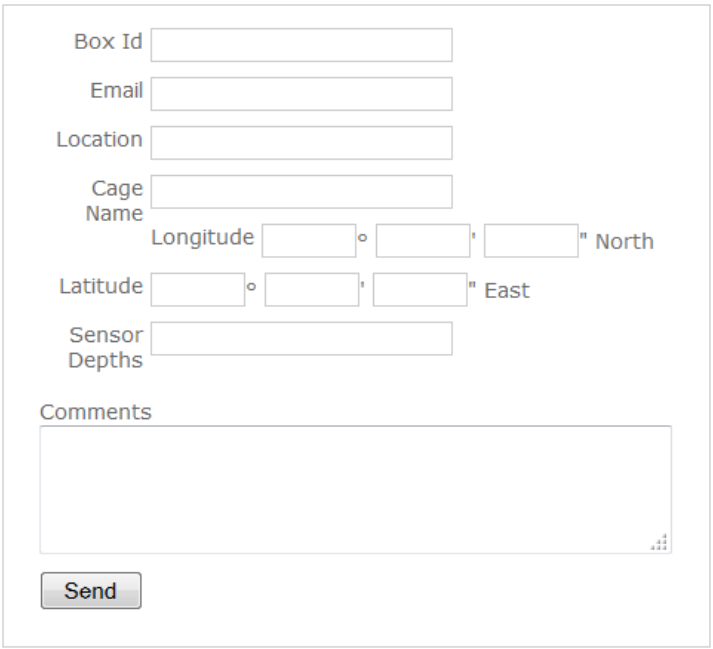
- logs off the user and opens the log on page

Manuals

- opens pdf user manuals in the website

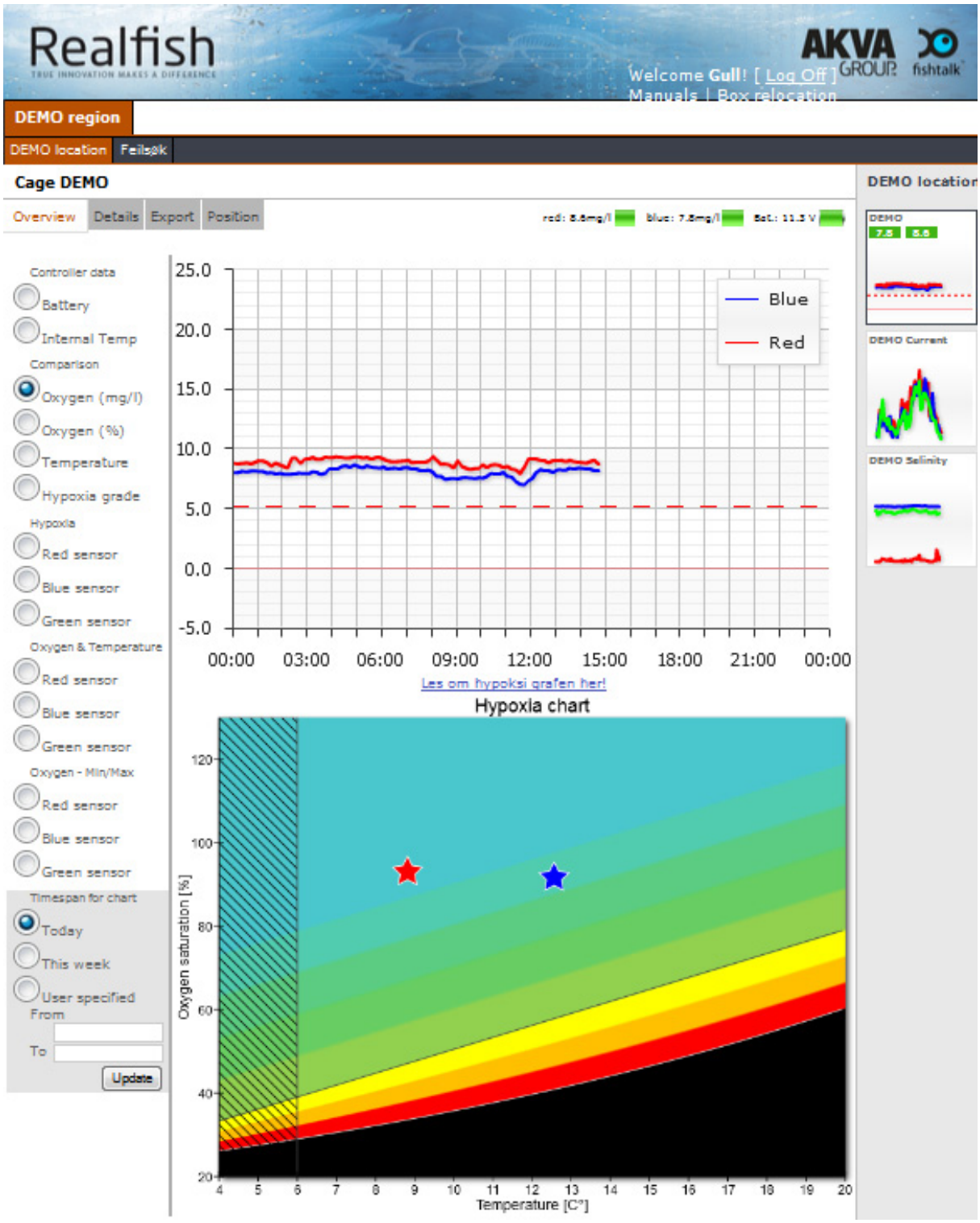
Box relocation

- opens a form that must be filled out and sent if and when the AOS Box is being relocated to a new cage or location:



5.2 Overview

This first page of any location shows one of several measurement results of the chosen sensor in this location:



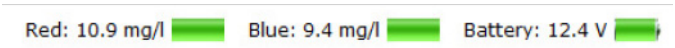
Read more about Hypoxia by clicking on the blue link between the oxygen graph and the hypoxia chart.

5.2.1 Miniature frames

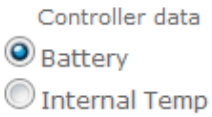
The miniature frames in the right column of the website show a simple overview of the measurements, oxygen, salinity and current wherever these sensors are registered and connected to the system. Measured values are shown in correct colours, where for instance green oxygen levels show that everything is ok at the moment, and yellow levels indicates that something is wrong and needs special attention right away.

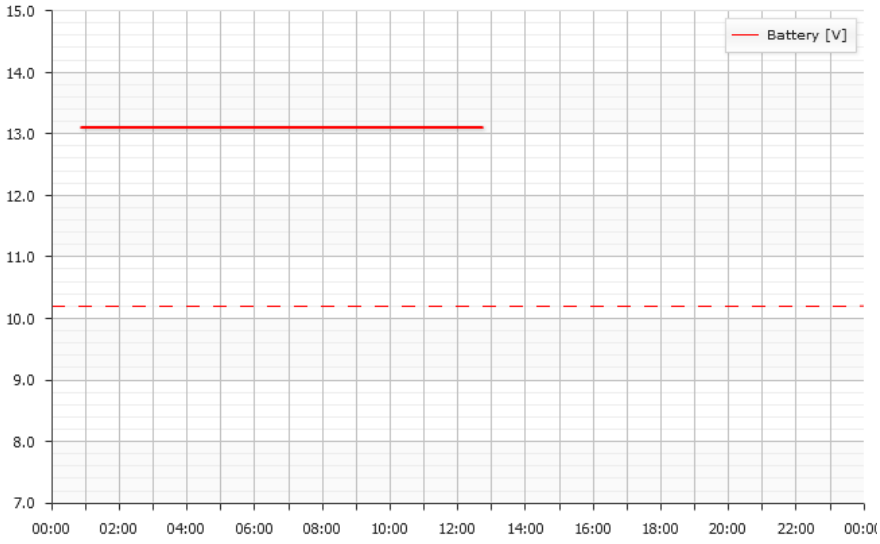
5.2.2 Controller data

Controller data battery level is shown in the right side above the graphs:



The battery level may also be shown graphically as a function of the time:

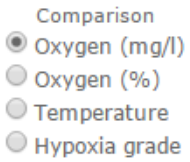


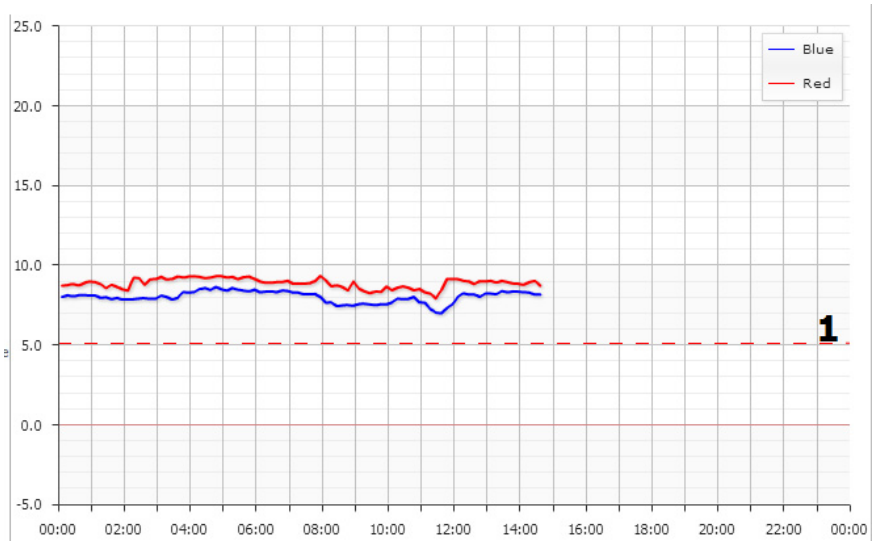


The internal temp. function shows temperature measurements from the inside of the AOS Box as a function of the time. Contact AKVA service personnel immediately if unexpected variations in this temperature is discovered.

5.2.3 Comparison

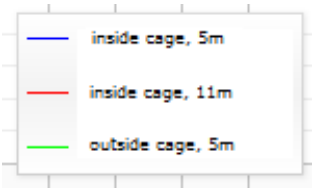
Oxygen level may be shown graphically as mg/l or %, and shows all measurements as a function of the time. This graph shows red and blue oxygen sensor measurements in mg/l for selected time span. Oxygen % is saturation values.





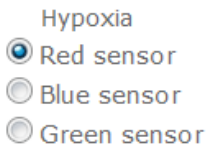
Oxygen levels in the mg/l-graph also shows a red dotted line (1). This line indicates critical oxygen level. If the graph for measured oxygen is below this value, site manager or other responsible personnel must firstly check the sensor and its membrane. If the sensor is placed inside the cage, sprout concentration in the net must also be controlled. If sprout is not the reason for the decreased measurements, contact AKVA service personnel for further inspection of the problem, and if possible, use an alternative oxygen sensor to find out if the levels are too low, or if it is the sensor that causes these measurements.

In case of too low oxygen levels, take immediate action to keep the fish from suffering from hypoxia, and stop feeding and any stress as soon as possible. Read more about hypoxia and how this effects the fish in chapter 5.2.4.

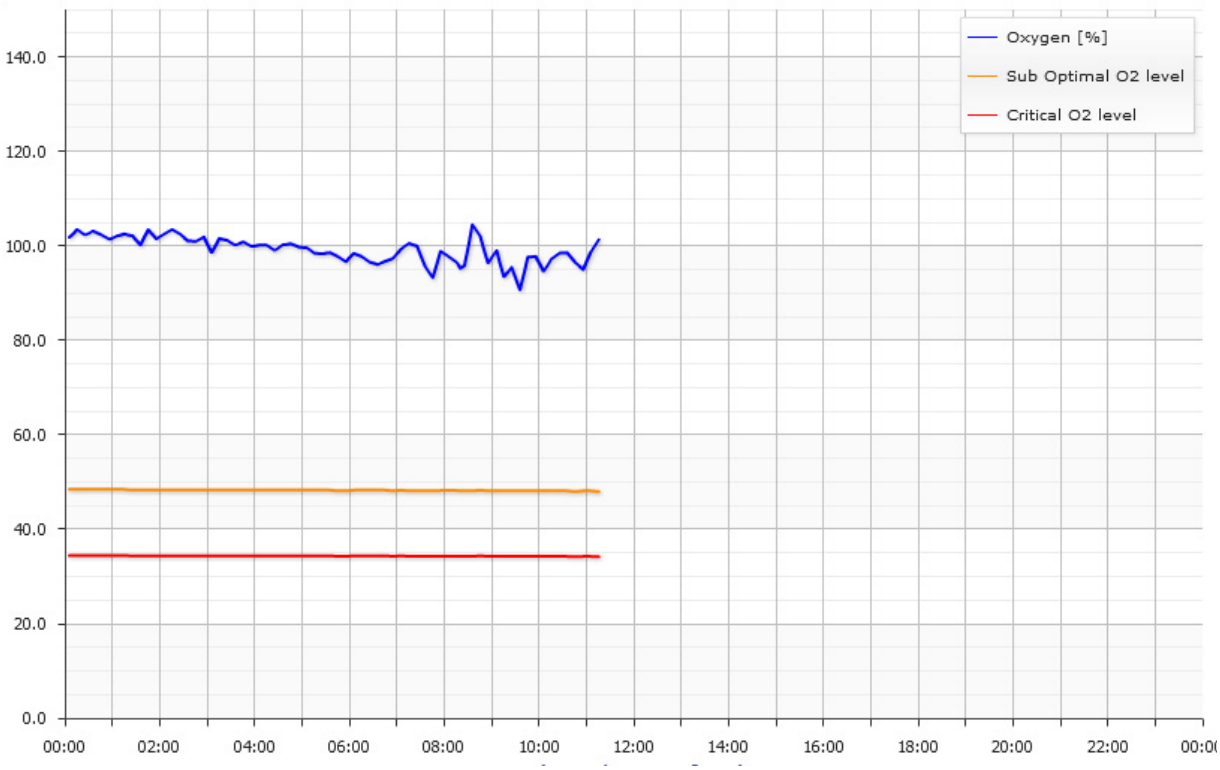


Sensors may be named after where they are placed. Naming is done by Nortek before starting to use the sensors.

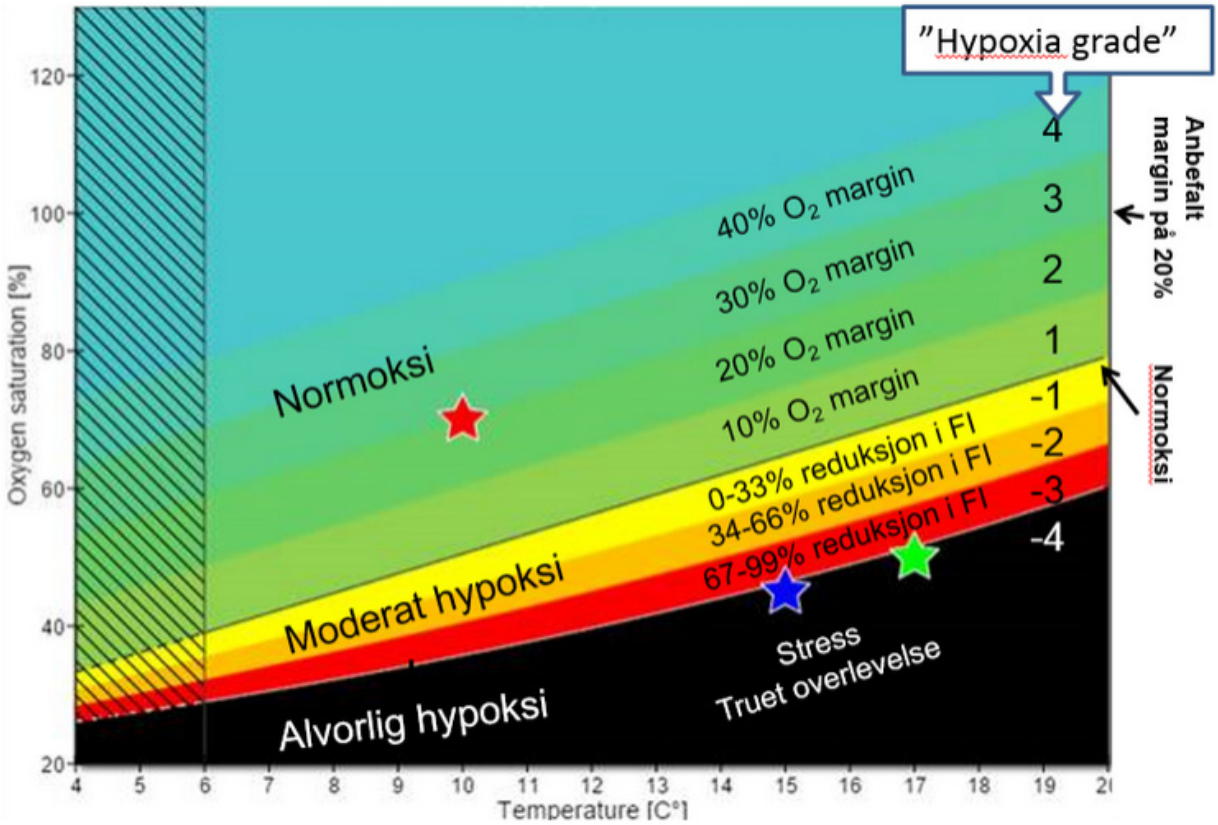
5.2.4 Hypoxia



Hypoxia is graphically represented for one oxygen sensor (choose colour) at a time. Choose desired sensor in the menu on the left, and the oxygen values are shown in the graph, as saturation as a function of the time span. Yellow and red lines indicates critical values as function of the water temperature.



Hypoxia diagram colour coding



All values in the graph are based on general tolerances for post-smolt salmon under 1kg

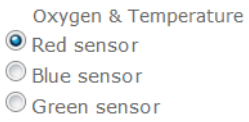
The stars in the diagram represent measured values from the three different oxygen sensors (blue, red and green).

When the oxygen level is above the Normoxia-line, when the Hypoxia grade is 1 or higher, all is ok.

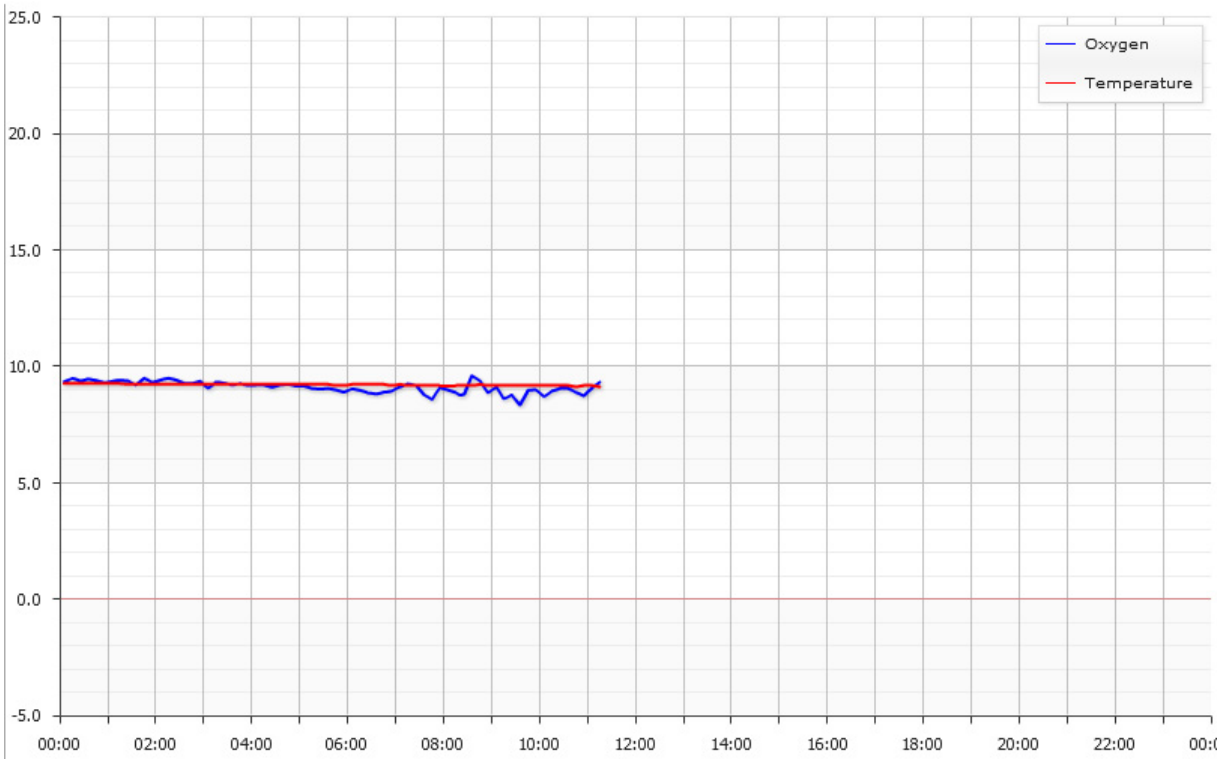
When the oxygen level goes below the Normoxia level, and the hypoxia level is moderate, between -3 and 1, it is recommended that feeding is reduced. If the Hypoxia level goes below -3 all feeding and any other disturbance causing fish stress must be stopped because the survival of the fish is threatened within this Hypoxia area.

We strongly recommend that all fish farming sites operates with at least a 20% Normoxia safety margin, this meaning using an Hypoxia grade at minimum 2.0.

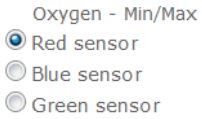
5.2.5 Oxygen and Temperature



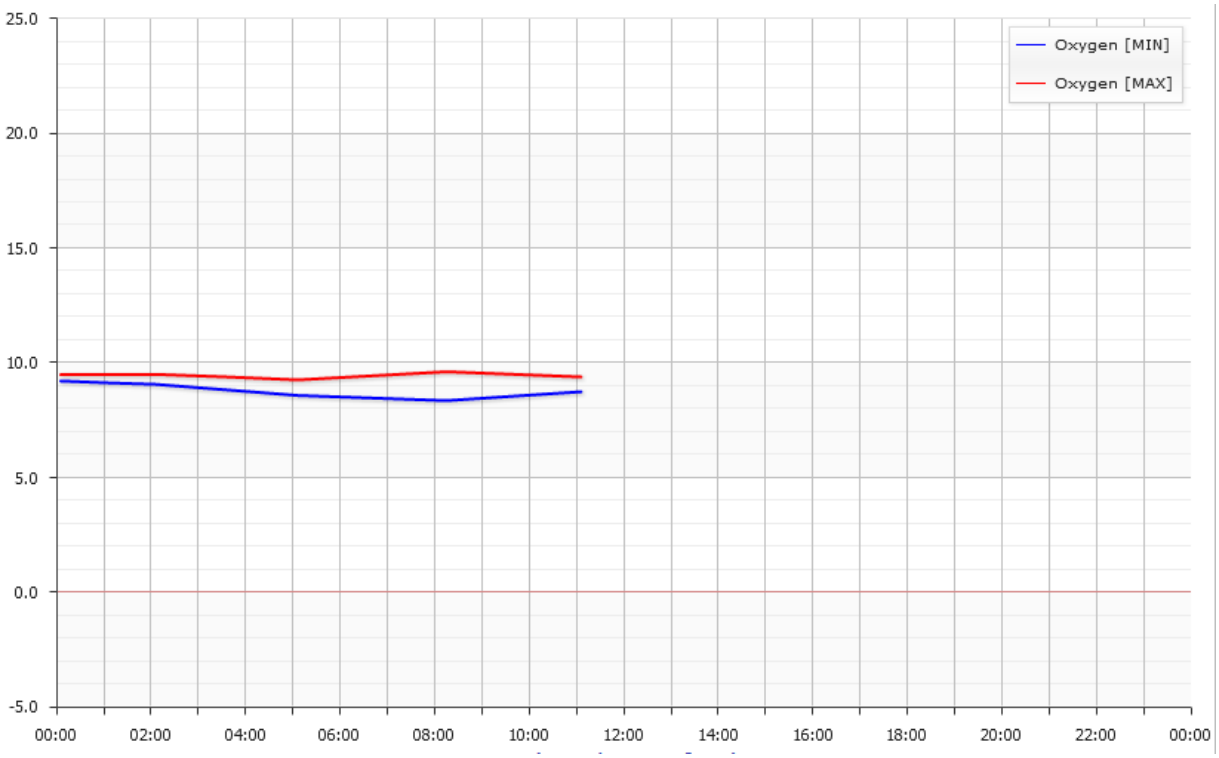
This function show two separate graphical measurements; one for oxygen and one for temperature from one of the used sensors (red, blue or green sensor) at a time.
The blue graph shows oxygen values as function of time, and the red graph shows temperature values as function of time.



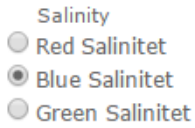
5.2.6 Oxygen min/max



This diagram shows maximum and minimum oxygen measurements for every third hour. Red line shows the highest measurement from the three hour period, and the blue line shows the lowest measurement for the same time interval. This provides a more accurate overview of the oxygen levels, as it shows larger time intervals. These measurements are stated as mg oxygen per litre water, as a function of time.

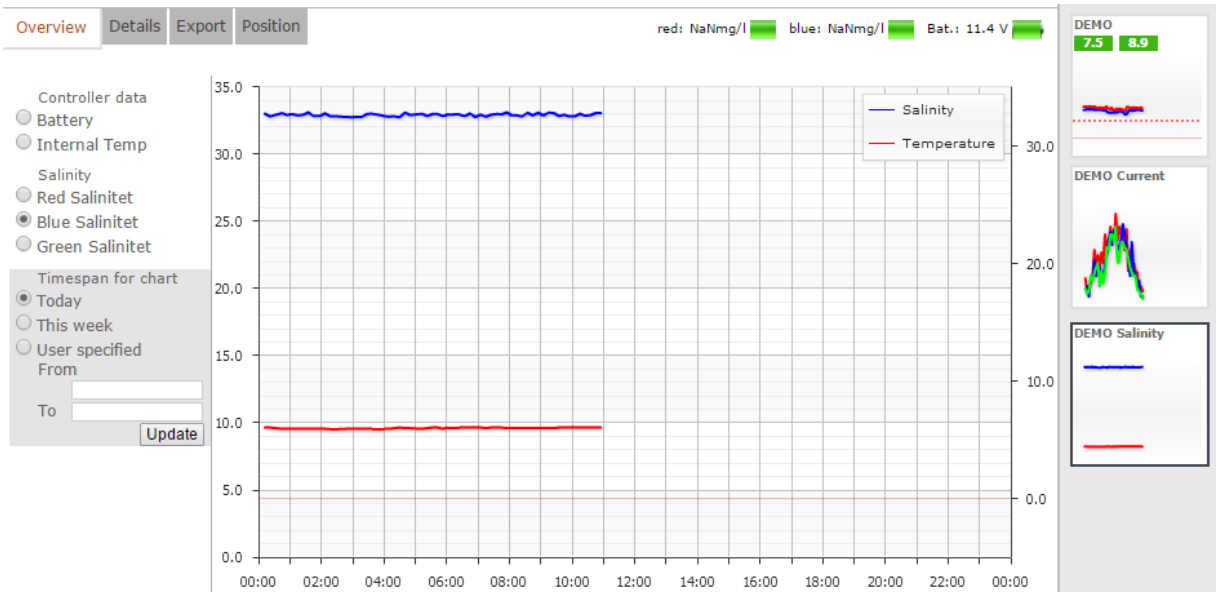


5.2.7 Salinity



This diagram shows measured salinity values from the chosen salinity sensor as a function of time.

The red line indicates temperature as function of time.

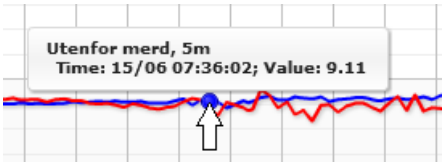


5.2.8 Timespan for chart

It is possible to customize time span for all diagrams. Choose between measurements for the current day, week or specified from one day to another.

A specific time may be shown in the charts, place the mouse pointer over desired point in the graph for designated timespan, and an information box with following information will appear:

- which sensor the graph represents, and where this sensor is placed
- sensor depth*
- date and exact time
- measured value at the chosen time



The mouse pointer may be moved around over the graph, and the user may choose which time, within the designated timespan that should be displayed in the information box.

**Let Nortek know where the sensors are placed before registration in order to show this information in the information box*

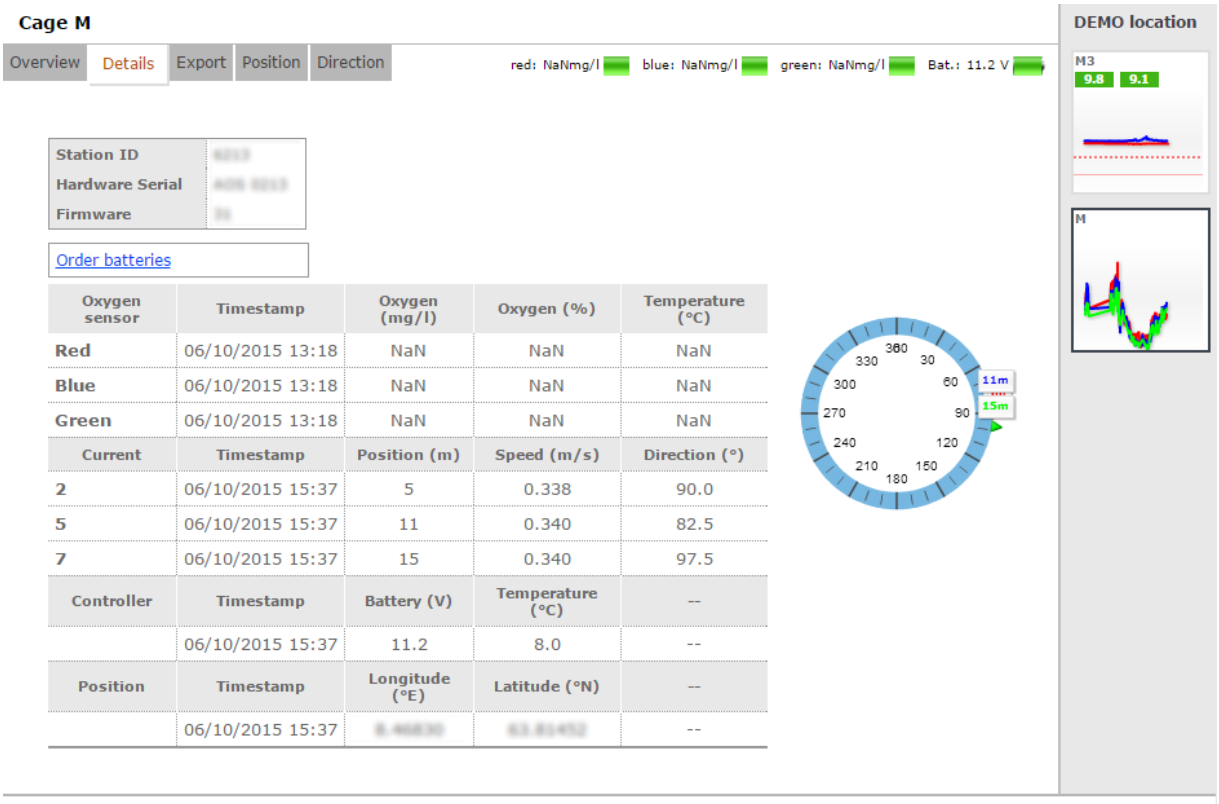
5.2.9 Speed and direction

This function shows measured current speed and direction from three different depths where AOS AKVA Sensor Buoy is installed.

See user manual for Sensor Buoy for more information on current measuring.

5.3 Details

Tables containing measurement details are found under the Details tab.



At the top, registered information about the AOS Box is found, hereunder Station ID, serial number and firmware.

When the battery indicator turns yellow, new batteries must be ordered. This is easily done by clicking the Order batteries-link. This opens a new page with a order form that must be filled in, and the batteries will be sent from Nortek to the location address shortly.

The **Oxygen sensor** table shows oxygen measurements in both % and mg/l, as well as temperature for the same timestamps.

Oxygen sensor	Timestamp	Oxygen (mg/l)	Oxygen (%)	Temperature (°C)
Red	06/15/2015 14:32	9.10	98.63	8.97
Blue	06/15/2015 14:32	8.91	96.52	8.97
Green	07/17/2013 09:34	NaN	NaN	NaN

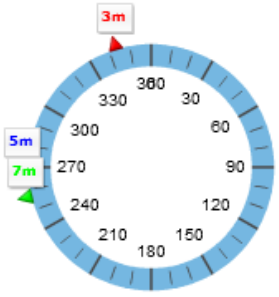
(Green sensor is not connected in the example above)

Salinity sensor measurements table shows salinity in ppt and conductivity (mS/cm), as well as temperature for the same timestamps.

Salinity sensor	Timestamp	Salinity (ppt)	Conductivity (mS/cm)	Temperature (°C)
Red	06/18/2015 10:57	2.2	4.1	8.53
Blue	06/18/2015 10:57	28.7	44.5	9.17
Green	06/18/2015 10:57	26.8	41.7	9.46

The **Current** table shows current measurements if an AOS AKVA Sensor Buoy is installed in the location. Current directions appear both in the table as well as graphically in the compass. This way, the current directions may easily be compared. Current speeds are shown in the table.

Current	Timestamp	Position (m)	Speed (m/s)	Direction (°)
1	10/14/2013 12:30	3	0.021	343.5
2	10/14/2013 12:30	5	0.056	270.0
3	10/14/2013 12:30	7	0.113	256.5



Read more about the Sensor Buoy and current measurements in this product's own user manual. This, and other user manuals are found in www.akvagroup.com/products/user-manuals

The **Controller** table shows battery status for the AOS Box, as well as temperature from inside the box. All values relates to the same timestamps.

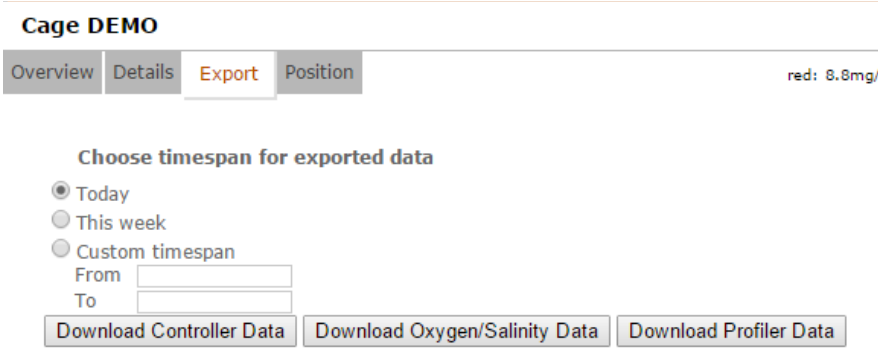
Controller	Timestamp	Battery (V)	Temperature (°C)	--
	06/15/2015 14:32	13.1	5.5	--

The AOS Box's GPS **Positions** are shown in the bottom table for the desired timestamps.

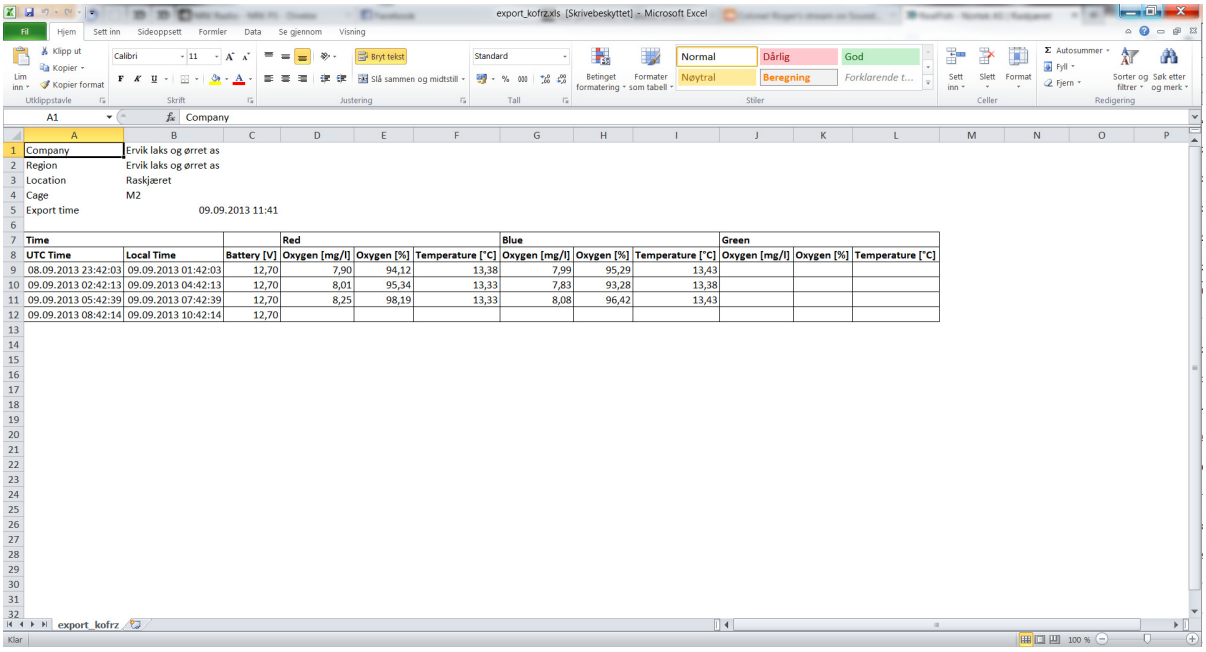
Position	Timestamp	Longitude (°E)	Latitude (°N)	--
	06/15/2015 14:32	8.87991	63.76152	--

5.4 Export

Data saved in Realfish may be exported to a computer for historical data back-up and possibility of printing reports. This makes it possible to process the information, and storing this in paper format if this is desired.



Choose desired time interval, click desired Download button, choose if and where the file should be saved, or choose open. The document will open automatically in Microsoft Excel if this program is installed on the computer.



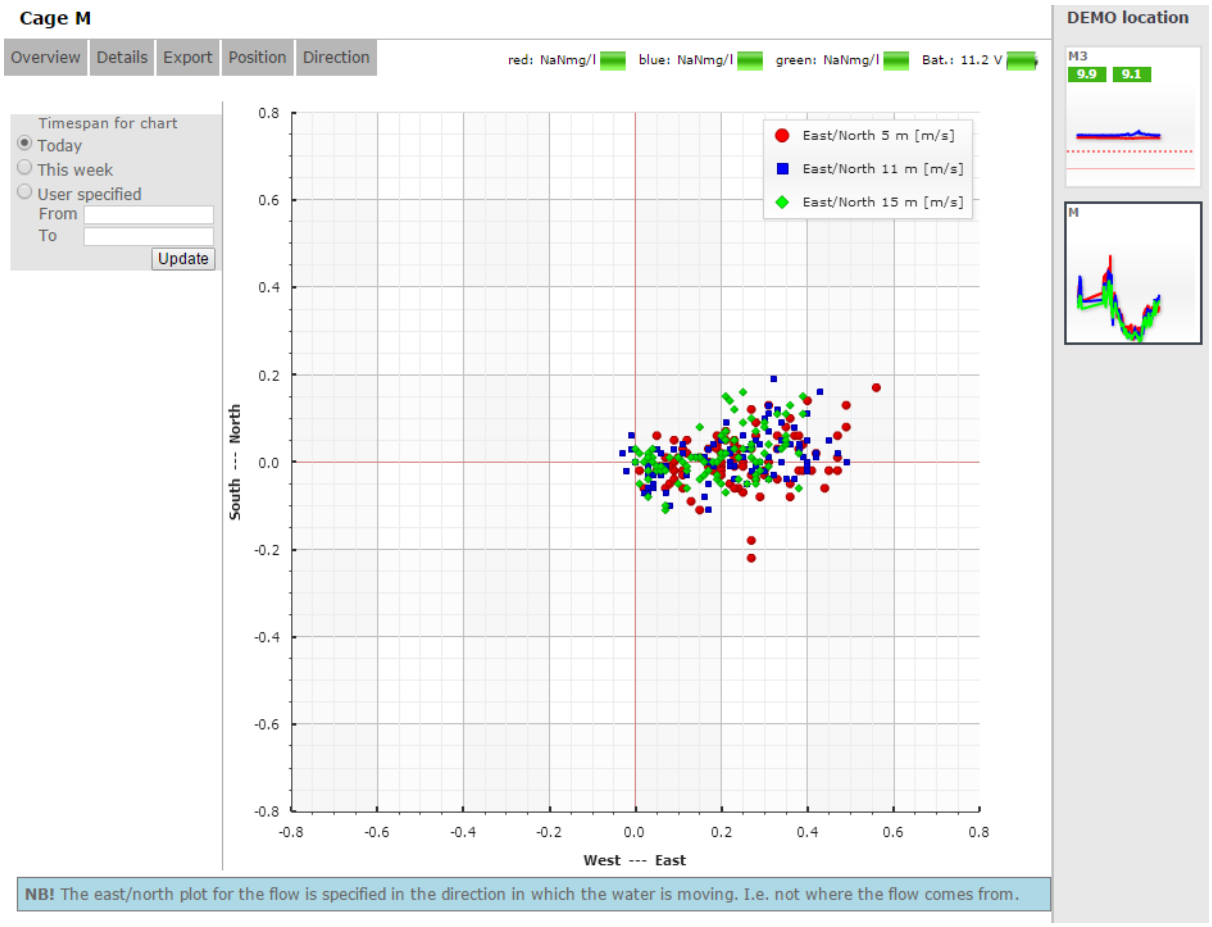
Company	Ervik laks og ørret as											
Region	Ervik laks og ørret as											
Location	Raskjæret											
Cage	M2											
Export time	09.09.2013 11:41											
			Red			Blue			Green			
UTC Time	Local Time	Battery [V]	Oxygen [mg/l]	Oxygen [%]	Temperature [°C]	Oxygen [mg/l]	Oxygen [%]	Temperature [°C]	Oxygen [mg/l]	Oxygen [%]	Temperature [°C]	
08.09.2013 23:42:03	09.09.2013 01:42:03	12,70	7,90	94,12	13,38	7,99	95,29	13,43				
09.09.2013 02:42:13	09.09.2013 04:42:13	12,70	8,01	95,34	13,33	7,83	93,28	13,38				
09.09.2013 05:42:39	09.09.2013 07:42:39	12,70	8,25	98,19	13,33	8,08	96,42	13,43				
09.09.2013 08:42:14	09.09.2013 10:42:14	12,70										

5.5 Position and Direction

Position diagram shows placement of the sensor buoy (measuring currents) in the map (GPS-position), measured direction as well as current speed at the chosen time.

The points in the chart are created as a function of north-east coordinates for the three different depths (divided by colour).

For each measurement in the period of time, one point is added to the diagram as a north-east based value. This provides a "cloud" of points, showing how the current measurements are scattered, and showing how many of the measurements are north-eastern. It is possible to space out one of the measurements, by placing the mouse pointer over the description of the deep (in the top right corner of the chart).



6 Storage

Make sure that the AOS Box is turned off before storing it. To shut the box down, press the ON/OFF button found inside the box panel for about 10 seconds.

The sensors need to be stored so that they are protected from random and possible careless handling, always use the protection stockings over the sensors whenever they are not being used. This will reduce the risk of mechanical damages.

The sensors must not be exposed to cold temperatures due to calibration reasons.

7 Batteries

The system is delivered with three 100Wh alkaline batteries (none rechargeable) that should provide the system with continuous power for estimated period of 4 months. How long the batteries will last will vary with temperature and the location Iridium-signals. The web site will indicate status for the batteries at all times. When the indicator turns red, this indicates that the batteries must be changed.

The blind plugs must be attached to the AOS Box contacts whenever the sensors are not connected to the box. The plugs protect the contacts from corrosion and prevents electric short circuit. Do not remove the blind plugs until the sensor cables are going to be reconnected to the AOS Box.

The batteries in the AOS Box must only be changed indoors

Immediately after the sensors are disconnected from the box, the blind plugs must be attached to the AOS Box contacts. The contacts must never ever be exposed to seawater

Take extra care of the panel bolts during battery change

7.1 Turn off the AOS box

When sending the AOS Box to service, changing batteries or moving it for any other reason, the box must be turned off.

1 Take up the sensors out from the water, and bring the AOS Box with sensors indoors

2 Disconnect sensors and replace the them with blind plugs. Put the sensor protecting stockings on the sensors and place them somewhere safe and out of the way of personnel

3 Wipe off any water residues from the outside of the box

4 Open the box and turn the system off

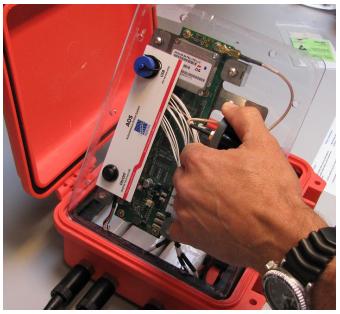
7.2 Change batteries

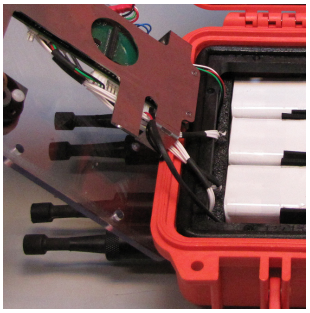
1 Turn off the AOS Box as instructed above (chapter 7.1)

2 Remove all the 10 bolts in the panel

! *Take good care of the bolts during the battery change*

3 Flip the panel to the left and lean it over the edge if the box so that it stands steadily against the antennas on the side of the box. Make sure that none of the wires are pulled out during this process





4 Remove the batteries one by one and pull out the contacts from each battery

5 Notice how the batteries are placed in the box and place the new batteries in the same position as the old ones.
Re-connect the wires before placing the batteries in the box

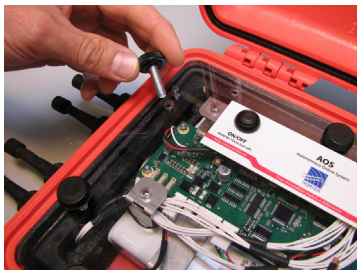
! *All batteries have to be changed at the same time!*

6 Check that all connections are in place according to the printed card

7 Flip the panel carefully back into place and make sure that none of the wires are caught between the panel and the box

Make sure that no wires are placed on top of the batteries, nor along the gaskets

8 Fasten and tighten all 10 bolts and turn the system back on as described in chapter 3



9 Close the AOS Box properly, remove stockings and connect sensor cables, then bring the system back to the location. Fasten the AOS Box properly to the bracket on the cage edge as described in chapter 3.1.

8 Service and repairs

Before sending the AOS Box to AKVA group via Nortek AS for service or repairs, contact us via e-mail and receive a RMA-number. RMA is a reference number needed for us to provide fast and problem free handling of your shipment. Contact information is found in the back of this manual.

Information that must follow any shipments:

- RMA number
- AOS Box Station ID (found inside the AOS Box lid)
- Company name
- Location name
- Contact person, location
- Delivery address, location
- Invoice address
- Phone number and e-mail address for Site manager

8.1 Shipment insurance

Shipment insurance for repair shipments are not covered by AKVA group. Make sure that the equipment is properly covered by Your insurance. AKVA group is not responsible for direct costs or costs from consequential damages when equipment is lost or destroyed during transport. Shipment insurance back to customer after maintenance or repairs is covered by Nortek, and will be invoiced by AKVA group along with work and shipment costs. Transport and shipment to customer insurance regarding warranty repairs, will be covered by Nortek.

9 Maintenance

9.1 Cleaning the sensors

Be aware of that sprout on the oxygen sensors may affect the measurement accuracy.

- sprout may cause average values to vary from normal, and most often the value will decrease massively
- abnormal variations between measurements may occur
  - large variations from one hour to another
  - large variations from day- to night-time

Net sprout will affect the measurements inside the cage. Regular control of the net with camera, and following cleaning when necessary is therefore recommended.
This will normally be a bigger issue in the algae growth is at its most, during the warmer seasons. In these periods, it is necessary to control and clean the net and sensors more often.

Clean the sensors carefully with a soft sponge, cloth or brush, for instance a toothbrush that will fit perfectly in the salinity sensor measurement opening.
If the oxygen sensor membrane is broken after excessive or incorrect cleaning, it needs to be sent to the producer for change and recalibrated.

Do not use any sharp or hard tools for cleaning. This may cause irreparable damages to the sensor membrane

Prior to cleaning the net, all sensors must be taken out of the water, both the ones placed inside as well as outside of the net. All sensor cables are connected at the cage edge, and are all at risk of getting hooked into the net cleaner if they hang freely during the cleaning process.

Take sensors out of the water prior to net cleaning

9.2 Maintenance registration for AOS Box

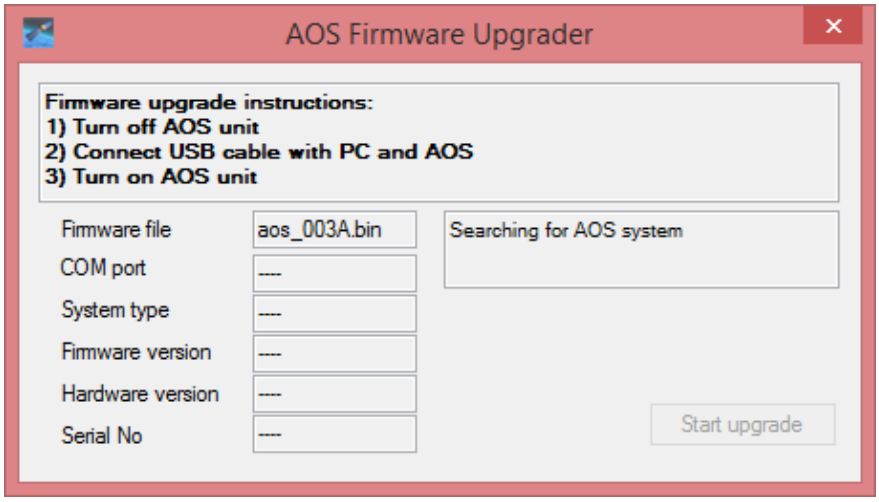
Make copies of this form before filling anything out

Date	Parameter	Next maintenance	Sign.

10 Update AOS Box

In order to use salinity sensors with the AOS Box, the software needs to be updated. This is done by connecting the AOS Box to a PC using the mini USB cable and the USB gate in the panel inside the box.

Contact Nortek to receive access to AOS Firmware Upgrader:



After the upgrade, the box requires configuration. Contact Nortek once again and they will perform this configuration.

Contact information Nortek:

- E-mail: support@nortek.no
- Phone: 67 17 45 00

AOS Box without USB-port in the panel inside the box can not be upgraded to salinity use. These can only measure currents and oxygen.

10 Spare parts for AOS Box

For supplement orders of sensors, use these item numbers:

Sensor	**Oxygen**	**Salinity**
Red	10001601	10001604
Blue	10001602	10001605
Green	10001603	10001606

For supplement orders of sensor cables:

Length	**Oxygen sensor**	**Salinity sensor**
20 feet (6m)	10001166	10001207
33 feet (10m)	10001515	10001367
82 feet (25m)	10001387	10001516
164 feet (50m)	10000615	10001208
246 feet (75m)	10000616	10001209
328 feet (100m)	10000617	10001210

All sensors are delivered with cable and plug.

AOS Box batteries, item no. 0105891

Order new batteries from the website, see chapter 5.2 for instructions

Back up blind plugs may be ordered with the following item no.:

- 5 pin blind plug: 10001520 (oxygen + salinity connections)
- 8 pin blind plug: 10001239 (Doppler connection)

12 Frequently asked questions

Most problems that occur with the AOS Box are caused by simple issues. Therefore, we ask you to please check the following if any problems occur with the AOS Box before contacting AKVA service personnel:

1 Is the cable in order? Cross-check by switching the cables:
   - if a cable is broken, it will not measure from any of the contacts
   - if the cable measures from any of the other contacts, this may indicate problems with the contact

2 Have the batteries got run down?
   (check the web site, see chapter 5.2.2)

3 Are all wires in order and connected properly?

4 Does the AOS antenna have clear sight towards the sky?

5 Are the sensor or the cage net covered with sprout?

Appendix A - Index

A
accuracy 6, 13, 41
activate 14-16

B
battery 6, 9, 11, 13, 22, 30, 32, 36, 37
bolts 7, 15, 36, 37, 39

C
chord anchorage 7, 14-16
contacts 13, 15, 16, 36, 38, 45
current 19-21

E
exporting data 22

F
fastening bracket 6, 9, 11-13

I
ID number 12, 16
Iridium 9, 10, 24

L
log on 16

M
measurement 9, 15, 17-21, 29
mechanical strain 6, 11

N
new location 29
notifications 17

O
ON/OFF-button 11, 12, 23
oxygen level 9, 17-19, 21, 29

P
panel 11, 12, 25, 28
protection stocking 5, 11, 12

R
resolution 10
RMA 28

S
saturation 19, 21
shipment 5, 28
sprout 19, 29

T
temperature 5, 9, 10, 19, 21, 23, 24
time intervals 20, 22
timespan 20
transport 5, 24, 28

W
warranty 28
web site 9, 15, 17, 24

Appendix B - Deviation form

Make copies of this deviation form before filling anything in

Deviation control nr.:	

Unit:	**Producer:**	**Prod.no.:**	**Purchase year:**

Deviation description:
Follow up proposition:
Date and signature, declarer:

Follow up directed:
Status:
New action for deviation no.:
Date and signature, follow up:

Appendix C - Notes

Appendix D - Contact information

NORWAY - AKVA group ASA

Head Office

Nordlysveien 4

PO. Box 271

N-4340 Bryne

Norway

tel. +47 - 51 77 85 00

fax. +47 - 51 77 85 01

Support Hardware and AKVAconnect

tel. + 47 - 51 77 85 03

supportakvasmart@akvagroup.com

Support Fishtalk

tel. +47 - 73 84 28 20

supportfishtalk@akvagroup.com

DENMARK

AKVA group Denmark AS (Land Based)

Bødkervej 7A, 1.

7000 Fredericia, Denmark

t. +45 7551 3211

f. +45 7551 4211

AKVA group Denmark AS (Land based)

Rosklidevej 342, Building 2

2630 Taastrup, Denmark

t. +47 7551 3211

SWEEDEN

AKVA group - Agent: Modus Trading AB

Färjegårdarne 7

78461 Borlänge, Sweden

t. +46 - (0)243 883 22

f. +46 - (0)243 21 17 78

modus@dalnet.se

FINLAND

AKVA group - Agent: OY MG Trading AB

Ivisnäsplanen 2E

SF-02260 Esbo, Finland

t. +358 - 9867 68422

f. +358 - 9867 68420

ICELAND

AKVA group - Agent

Wise lausnir ehf

Borgartun 26, 105 Reykjavik, Iceland

t. + 354 545 3200

f. +354 545 3232

UK (SCOTLAND)

AKVA group Scotland Ltd.

36F Shore Street

Inverness, Scotland, UK

IV1 1NF

t. +44 (0)1463 221 444

f. +44 (0)1463 223 535

GREECE

Akvasmart/Fishtalk - Agent:

Zellas Trading Company

Dodekanisou Str., GR-174 56

Alimos, Athens, GREECE

t. +30 - 210 7014881

f. +30 - 210 7012666

zellastrading@ath.forthnet.gr

TURKEY

AKVA group Kültür

Balıkçılığı Ekipmanları Ltd. Şti.

Yeni Küçük Sanayi Sitesi No:1-C19 Baharlı Köyü

48200 Milas, Muğla, TURKEY

t. +90 - 252 - 374 - 6434

f. +90 - 252 - 374 - 6432

TUNISIE

AKVA group - Agent: Sociètè Mèditerranèenne

d`Etudes et Conseils

72, Avenue Habib Bourguiba

2080 Ariana, Tunisie

t. +216 71 700 453

f. +216 71 700 297

smechg@gnet.tn

CANADA

AKVA group North America Inc.

1495 Baikie Road, Campbell River

BC, V9W 1R9 Canada

t. +1 - 250-286-8802

f. +1 - 250-286-8805

AKVA group North America Inc.

5251 Duke Street, Suite 606, Duke Tower,

Scotia Square

Halifax, NS, B3J 1P3 Canada

t. +1-902-482-2663

f. +1 - 902-405-3373

CHILE

AKVA group Chile

Ruta 5 Sur Km.

1030, Puerto Montt, Chile

t. +56 - 65 250250

f. +56 - 65 257119

AUSTRALIA

AKVA group Australasia

t. +61 400 167 188

cschafer@akvagroup.com